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Contributions to the Life Histories of Several Penaeid Shrimps (Penaeidae) Along the South Atlantic Coast of the United States

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Contributions to the Life Histories of Several Penaeid Shrimps (Penaeidae) Along the South Atlantic Coast of the United States

By

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Biological Laboratory, Brunswick, Georgia

United States Fish and Wildlife Service
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Contributions to the Life Histories of Several Penaeid Shrimps (Penaeidae) Along the South Atlantic Coast of the United States

By

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ABSTRACT

Shrimp, the most valuable fishery resource of the south Atlantic coast of the United States, contributed about 40 percent of the $27 million exvessel value of all fishery landings in the area in 1966. Three species of shallow-water penaeid shrimps are of greatest commercial importance: white shrimp, Penaeus setiferus; brown shrimp, P. aztecus; and pink shrimp, P. duorarum. The shrimp fishery is reviewed for trends in yield for the area as a unit, by States, and by species, for the 10-year period 1958-67. A trend toward steady decline in total shrimp landings is indicated.

During studies on the white shrimp along the south Atlantic coast of the United States in 1931-35, data were obtained on the brown shrimp; the sea bob, Xiphopeneus kroyeri; and Trachypeneus constrictus. Observations were also made on the pink shrimp from operations of the Bureau of Commercial Fisheries R/V Oregon off northeast Florida near Cape Kennedy in 1965-67. This report presents size distribution, ovary development, and sex ratios of the several species of shrimp, and includes limited information on spawning season.

INTRODUCTION

During studies by the U.S. Bureau of Fisheries on the white shrimp, Penaeus setiferus, along the south Atlantic coast of the United States in 1931-35 (Lindner and Anderson, 1956), data were also obtained on several other species of penaeid shrimp along the South Carolina, Georgia, and northeast Florida coasts: the brown shrimp, Penaeus aztecus; the sea bob, Xiphopeneus kroyeri; and Trachypeneus constrictus. In addition, limited data were secured on the brown shrimp and on the pink shrimp, Penaeus duorarum, from operations of the Bureau of Commercial Fisheries R/V Oregon off northeast Florida near Cape Kennedy in 1965-67. This report gives a general review of the shrimp fishery in the south Atlantic region and presents data on certain aspects of the life histories of these species.

METHODS

Details about methods of operation, vessels, gear, and fishing grounds used in the 1931-35 studies were given by Anderson (1968). A description of the shallow coastal shrimp fishing grounds of the south Atlantic coast of the United States was given by Anderson, Lindner, and King (1949) and is also figured in Anderson and Lunz (1965).

Size of shrimp is total length, measured from tip of rostrum (head spine) to tip of telson (tail spine). The data are combined in 5-mm. groups, each of which is represented by the midpoint -- for example shrimp between 101 and 105 mm. total length are shown as 103 mm. and those between 106 and 110 are shown as 108 mm.

Unless otherwise stated, monthly data for the various years were combined to give average figures for each State.

In recording ovarian development, I used four successive stages -- undeveloped, developing, yellow, and ripe -- as described by King (1948).

Table 1 gives the average monthly surface water temperatures for the indicated sections of the fishing grounds from South Carolina to northeast Florida.

REVIEW OF THE FISHERY

Shrimp is the most valuable fishery resource of the south Atlantic coast of the United States (North Carolina, South Carolina, Georgia, and Florida east coast). In 1966, the last year for which complete fishery statistics are available, the exvessel value of shrimp was $10.8 million, or about 40 percent of the $27 million exvessel value of all fishery landings in the area.

Three species of shallow-water penaeid shrimps are of greatest commercial importance: white shrimp, Penaeus setiferus; brown shrimp, P. aztecus; and pink shrimp, P. duorarum. White and brown shrimps are taken in commercial quantities in all four States, and pink shrimp only in North Carolina.

The royal red shrimp, Hymenopenaeus robustus, a deepwater penaeid shrimp, is taken in limited quantities in 274 to 457 m. (150-250 fathoms) off St. Augustine, Fla. The 5-year average landing for 1963-67 was only 56,700 kilograms (125,000 pounds) of heads-on shrimp per year.

BCF (Bureau of Commercial Fisheries) has reported shrimp landings by species since 1957; consequently trends in species composition can be followed during 1957-66.

Shrimp landings for all species combined in the south Atlantic area averaged about 13 million kilograms (29 million pounds) of heads-on shrimp yearly during 1953-57, just under 11.3 million kilograms (25 million pounds) in 1958-62, and about 9.1 million kilograms (20 million pounds) in 1963-67. Thus the annual landings declined about 4 million kilograms (9 million pounds) in less than a decade (fig. 1).

In the 10-year period 1958-67, for which landings by species are available, average yearly landings of both brown and pink shrimp were about the same in 1963-67 as in 1958-62, but average yearly landings of white shrimp declined more than 1.8 million kilograms (4 million pounds) during the second half of the decade (fig. 1).

Year-to-year fluctuations in landings by species and for all species combined for

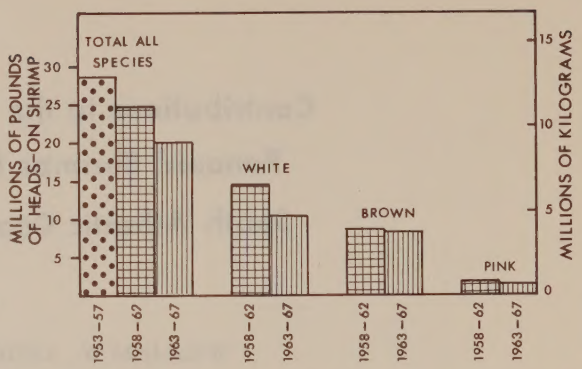

Figure 1.--Yearly average landings of shrimp on south Atlantic coast of the United States by 5-year periods, for all species combined, 1953-67, and for individual species, 1958-67.

1957-67 (fig. 2) indicate a trend toward steady decline in total shrimp landings. Anderson and Lunz (1965) said, "Yearly fluctuations are not necessarily abnormal for a resource that is now being harvested at near-maximum levels. Rather, they depict changes in abundance of fishable stocks available from year to year, and these changes reflect several factors influencing survival of the young -- for we are dealing with a new crop of shrimp each year."

Trends in annual shrimp landings in 1963-67 varied among the different States of the south Atlantic coast (fig. 3). Fluctuations were similar in South Carolina and Georgia, with low landings in 1963 and 1964, a bumper year in 1965, and a large decline in 1966 to a level maintained in 1967. The 1966-67 landings were greater than those in 1963-64, but in Georgia (the State with the largest production) the high in 1965 was not as pronounced as an earlier peak in 1960. The conditions that cause annual fluctuations evidently extend over both South Carolina and Georgia. These two States contain the heart of the nursery grounds in the south Atlantic area. Landings in Florida have been more stable, with slightly higher levels in 1965-67 than in 1963-64. In North Carolina, landings increased steadily from a low in 1963 to a high in 1966, but dropped somewhat in 1967.

The shrimp fishery of the south Atlantic coast is highly seasonal; landings are very low from January through May, begin to increase in June, and build rapidly to a peak during the summer or fall (figs. 4 and 5). This seasonal trend is followed in catches from each of the States.

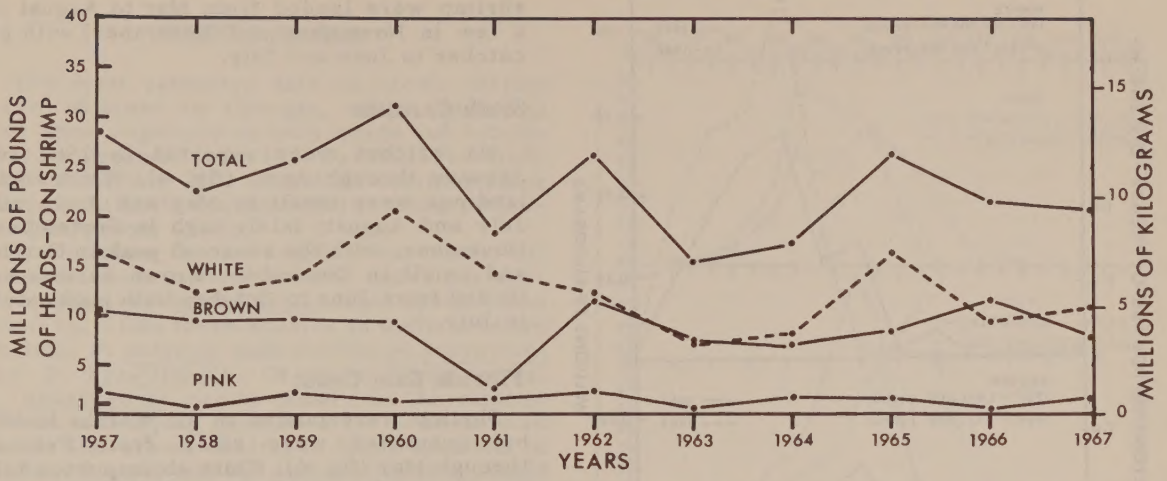

Figure 2.--Shrimp landings for the south Atlantic coast of the United States by year, by species, and for all species combined, 1957-67.

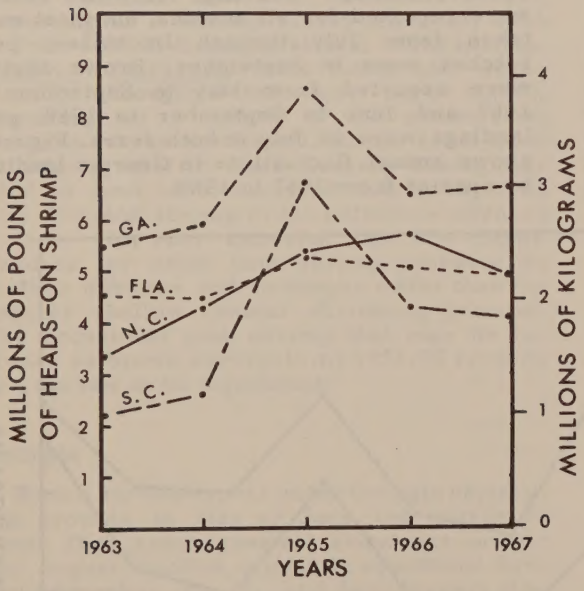

Figure 3.--Shrimp landings by State and year, 1963-67.

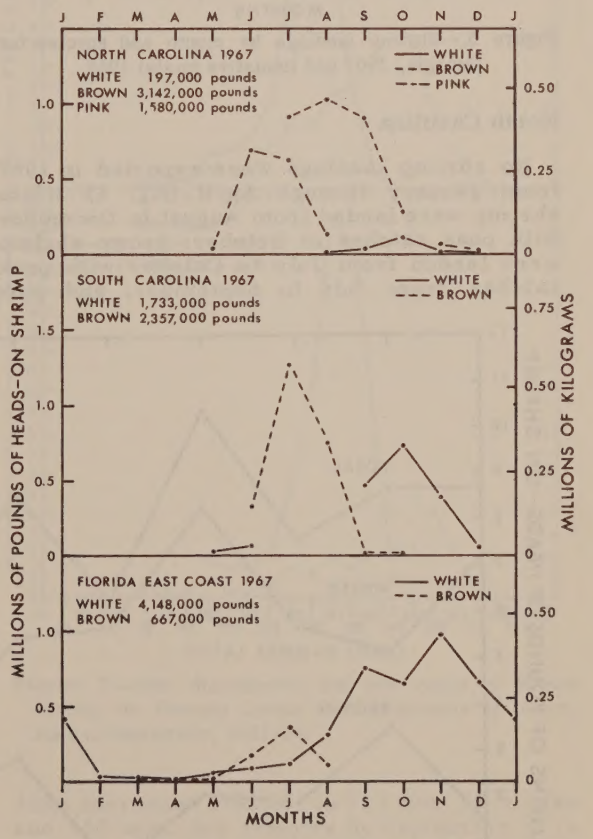

Figure 4.--Shrimp landings by month and species for North Carolina, South Carolina, and Florida east coast, 1967.

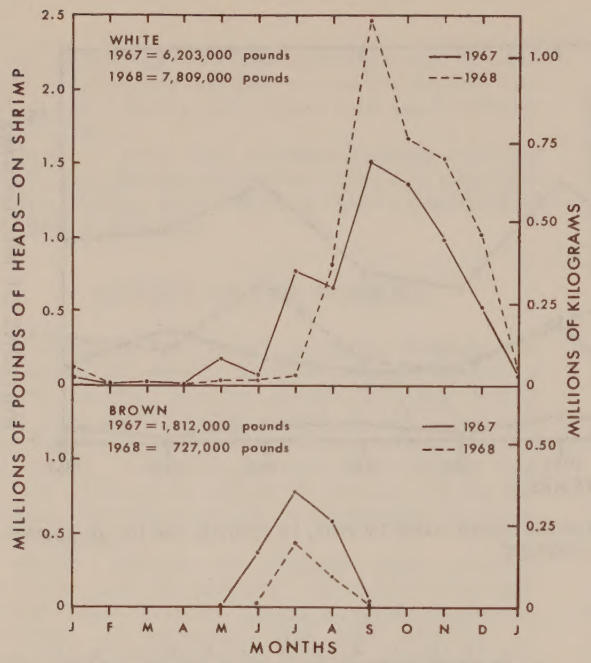

Figure 5.--Shrimp landings by month and species for Georgia, 1967 and (tentative totals) 1968.

North Carolina

No shrimp landings were reported in 1967 from January through April (fig. 4). White shrimp were landed from August to December with peak catches in October; brown shrimp were landed from July to October with peak catches from July to September; and pink shrimp were landed from May to August (an a few in November and December) with pea catches in June and July.

South Carolina

No catches were reported in 1967 fro January through April (fig. 4). White shrim landings were small in May and June; nil i July and August; fairly high in September t November, with the seasonal peak in Octobe and small in December. Brown shrimp wer landed from June to October with peak catche in July.

Florida East Coast

Shrimp were landed in all months in 196 but quantities were small from Februar through May (fig. 4). White shrimp were take in all months; catches reached the seasona high in November. Brown shrimp were re ported from March to August, with pea catches in July.

Georgia

Shrimp were landed in all months in 196 and in 1968, but the amounts were small fro January through May (fig. 5). White shrim were reported for all months, but most wer taken from July through December; pea catches were in September. Brown shrim were reported from May to September i 1967 and June to September in 1968; pea landings were in July in both years. Figure shows annual fluctuations in Georgia landing by species from 1957 to 1968.

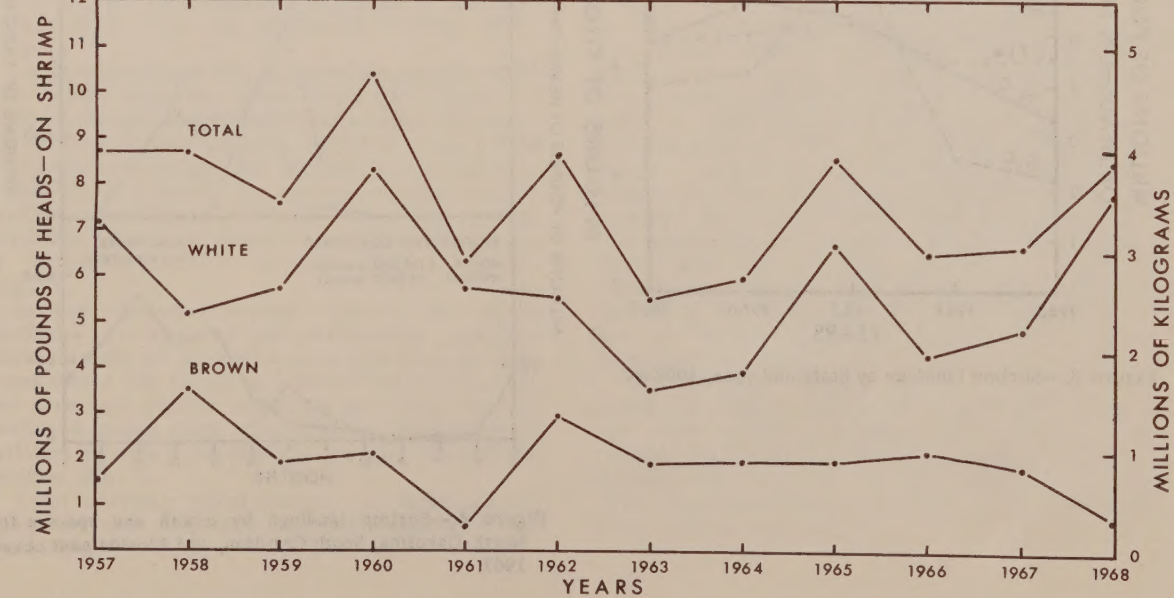

Figure 6.--Yearly shrimp landings by species and all species combined for Georgia, 1957-68.

BROWN SHRIMP

The most extensive data on brown shrimp were obtained in Georgia, where sampling was done regularly on both inside and outside shrimp grounds from 1931 to 1933. The study was extended in 1933 to include outside fishing grounds in South Carolina and northeast Florida (Anderson, 1968).

At the time these records were made, all grooved shrimp were included under one species, Penaeus brasiliensis. This species was later split into three species to include brown shrimp, P. aztecus; pink shrimp, P. duorarum; and P. brasiliensis. Of these three forms, P. brasiliensis rarely occurs in the shallow coastal shrimping grounds of the south Atlantic coast, the brown shrimp is fairly abundant in all four States, and the pink shrimp is abundant only in North Carolina.

Pink shrimp are seldom captured in the narrow coastal strip to which the regular shrimp fishery in South Carolina and Georgia is largely confined. Lunz (1963) did not report the capture of any pink shrimp during a 2-year shrimp survey in South Carolina from July 1960 to June 1962; and Bearden (1961) stated that, "P. duorarum is not at all common in South Carolina waters ...." Frisbie (1967), reporting on a shrimp survey from July 1966 to June 1967 in Georgia, stated, "Pink shrimp, Penaeus duorarum, were taken only occasionally throughout the year." Joyce (1965), reporting on a survey of the commercial shrimps of the northeast Florida coast from St. Marys Inlet to Cape Kennedy during July 1962 to June 1963, reported that he captured only 264 pink shrimp in the outside or offshore waters. He also indicated that the major grounds for adult pink shrimp probably lie farther offshore and in deeper water than the regular shallow coastal shrimping grounds. The occasional pink shrimp that may be included as brown shrimp in my 1931-35 records are too few to be significant.

Georgia

Brown shrimp appear on the Georgia shrimping grounds in May or June, but usually in June. They reach greatest abundance in July and August, decline rapidly in abundance during September (fig. 5), and have largely disappeared from the fishery by October (in some years a few remain until November). Therefore, data in significant amounts are confined to June, July, August, and September.

Size distribution.--The length of brown shrimp from inside grounds (sounds and rivers) increased gradually with the progress of the fishing season (fig. 7). Modes of 103 to 108 mm. for males and 118 to 123 mm. for females in June increased steadily to 133 mm. for males and 158 mm. for females by September. It is difficult to link this size increase with growth rates because small shrimp were continuously being recruited onto the grounds and some of the larger shrimp were moving to outside waters.

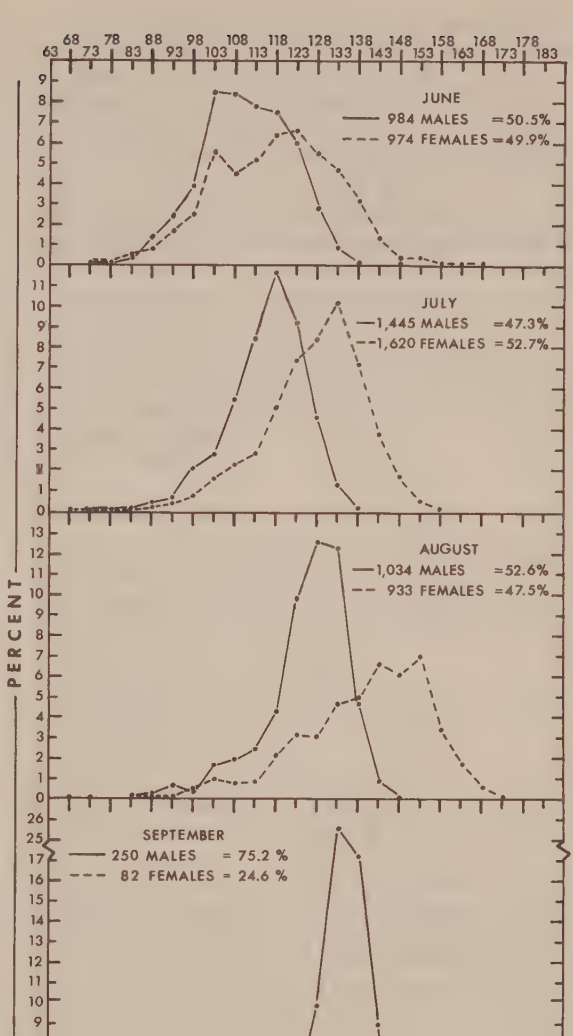

Figure 7.--Size distribution and sex ratios of brown shrimp on Georgia inside fishing grounds by month, June to September, 1931-34.

As on the inside grounds, the size of brown shrimps taken on the outside grounds (fig. 8) increased steadily from June (modes at 108 mm. for males and 123 mm. for females) to September (modes at 133 to 138 mm. for males and 158 mm. for females). Again it is difficult to link these size increases with growth rates as the shrimp were evidently rapidly leaving the Georgia fishery by September (many probably left in August). The few brown shrimp caught in October were of similar size to those taken in September.

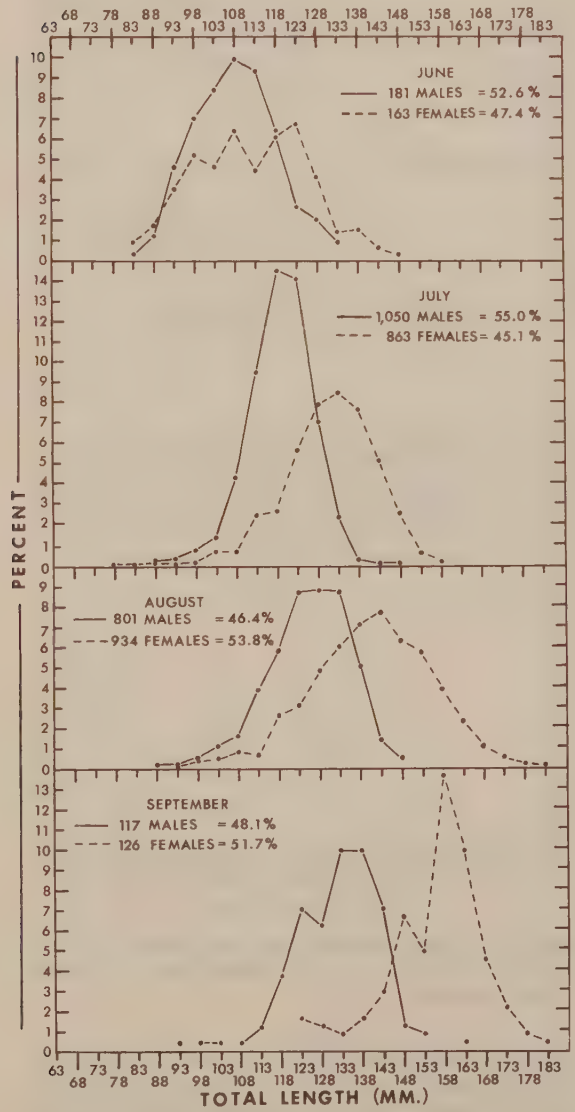

Figure 8.--Size distribution and sex ratios of brown shrimp on Georgia outside fishing grounds by month, June to September, 1931-35.

Ovary development.--All female shrimp taken on the inside grounds in June and July were undeveloped; in August 93.7 percent were undeveloped, 5.4 percent were developing, and 0.9 percent were yellow; and in September 71.9 percent were undeveloped, 26.9 percent developing, and 1.2 percent yellow (table 2). The smallest shrimp with developing ovaries was 133 mm. long, and the smallest with yellow stage ovaries was 148 mm. No ripe females were taken on the inside grounds.

On the outside grounds all females captured during June and July were undeveloped except for one developing stage shrimp in July; in August 90.5 percent were undeveloped, 9.3 percent developing, and 0.3 percent yellow; and in September 30.1 percent were undeveloped, 34.1 percent developing, 32.6 percent yellow, and 3.2 percent ripe without attached spermatophores (table 3). Of 38 females recorded for October (not shown in table 3), 26, or 68.4 percent, were undeveloped; 2, or 5.2 percent, developing; 1, or 2.6 percent, yellow; and 9, or 23.7 percent, were ripe without attached spermatophores; lengths ranged from 153 to 178 mm. On the outside grounds the smallest shrimp in different stages of development were: developing ovaries, 138 mm.; yellow, 148 mm.; and ripe, 153 mm. (collected in October).

Frisbie (1967), in discussing brown shrimp in Georgia, said, "Evidence of possible spawning of brown shrimp 1 mile offshore of Sapelo Sound (area B) was indicated by a catch of maturing shrimp on October 11, 1966. Two ripe females, 143 and 145 mm. long contained male spermatophores. Three other ripe but unfertilized females, four yellow, three developing, one spent, and six undeveloped specimens were included in the sample."

These records indicate that spawning possibly occurs off the Georgia coast during the fall but is probably very limited within the range of the shallow coastal fishery. Certainly the few ripe females taken during September and October are not commensurate with the abundance of the species during July and August.

South Carolina

Brown shrimp appear on the South Carolina outside fishing grounds in June, reach peak abundance in July and August, decline rapidly in abundance during September, and have nearly disappeared from the fishery by October (fig. 4). This situation is parallel to that in Georgia. I have records from June to September.

Size distribution.--Modes of length distribution of brown shrimp from the outside grounds increased steadily from 103 mm. for

males and 98-108 mm. for females in June to 123 mm. for males and 138 mm. for females in August (fig. 9). The modes then decreased, however, to 113 mm. for males and 128 mm. for females in September -- which I attribute to a migration of much of the population from the shallow coastal fishing grounds. As in Georgia, it is difficult to link the size increases from June to August with actual growth rates because the shrimp were apparently rapidly leaving the fishery by August and September.

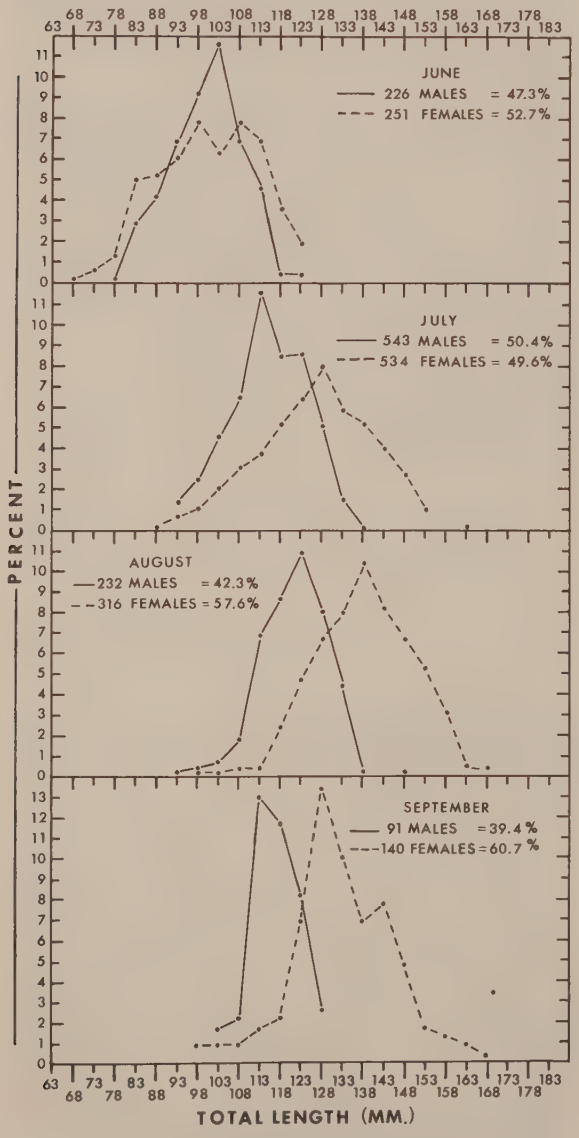

Figure 9.--Size distribution and sex ratios of brown shrimp on South Carolina outside fishing grounds, by month, June to September, 1933-34.

Ovary development.--Among shrimp captured in outside waters, all were undeveloped in June and July except for one in a developing stage in July; in August 98.5 percent were undeveloped and the rest were developing; and in September 98.6 percent were undeveloped and the rest were developing (table 4). The smallest shrimp with developing ovaries was 148 mm. Ovary development during August and September was far less advanced on the South Carolina grounds than on the Georgia grounds.

Recruitment of postlarval brown shrimp into South Carolina inshore waters occurs from January to May (Lunz, 1963). These larvae could originate from spawning sometime during the fall or winter, but the spawning site is unknown.

Northeast Florida

Brown shrimp appear on the shallow northeast Florida shrimping grounds in about April and reach peak abundance about July. By September few remain on the grounds.

Size distribution.--Figure 10 gives the size distribution and sex ratios of brown shrimp for outside waters of the shallow coastal fishery for May through September.

The few shrimp taken in May were considerably smaller than those found in June, when the mode was 123 mm. for males and 133 mm. for females. The mode for females dropped to about 128 mm. in July and August, but the mode for males remained at about 123 mm. In September the modes were 133 mm. for males and 138 mm. for females -- not much different from the sizes in June. This unusual variation in size distribution from June to September is apparently the result of continued recruitment of small shrimp from the inside nursery grounds to the shallow coastal fishing grounds and migration of parts of the population (chiefly large shrimp) from the coastal fishing grounds to more offshore areas.

For years the abrupt decline in abundance of brown shrimp during September to October on the shallow coastal shrimp grounds of the south Atlantic coast has led to speculation that there must be a concentration of large individuals somewhere on the Continental Shelf beyond the coastal fishing grounds. Until 1965 no such concentration had been discovered. In January 1965 the BCF R/V Oregon located commercial concentrations of very large brown shrimp in 55 to 59 m. (30-32 fathoms) south of Cape Kennedy, and portions of the commercial shrimp fleet worked these grounds for several months. When the Oregon returned to these offshore grounds in March 1965 to

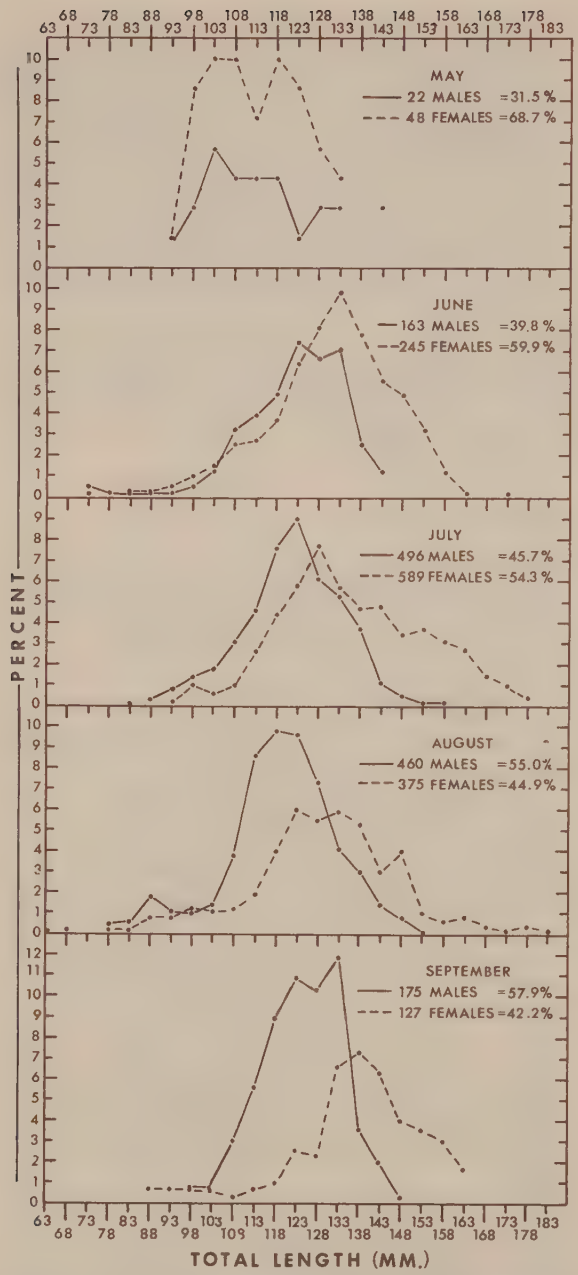

Figure 10.--Size distribution and sex ratios of brown shrimp on northeast Florida outside fishing grounds, by month, May to September, 1933-35.

reassess the location and stocks of large brown shrimp, the population was widely scattered and catch rates were below commercial levels.

The BCF Exploratory Fishing and Gear Research Station, Brunswick, Ga., furnished samples of shrimp from a number of Oregon trawl hauls of the March 1965 cruise, made between 18 and 24 m. (10-13 fathoms), and from a series of hauls made between 55 and 66 m. (30-36 fathoms). Table 5 gives data for these samples. At 20 to 24 m. (10-13 fathoms), the pink shrimp was the abundant species (only two brown shrimp were taken), whereas at 55 to 66 m. (30-36 fathoms) the brown shrimp was dominant (only five pink shrimp were among the samples). From the size ranges provided in table 5, it is evident that these offshore grounds between 55 and 66 m. (30-36 fathoms) have a population of adult brown shrimp of a general size much larger than that of shrimp on the shallow coastal fishing grounds, where the depths are under 18 m. (10 fathoms) and largely under 15 m. (8 fathoms).

Whether the population of large brown shrimp on the deep offshore grounds near Cape Kennedy, Fla., is recruited entirely from the shallow coastal fishing grounds of Florida or receives recruits from the Carolinas and Georgia is largely speculation. Several observations, however, support the latter possibility: (1) the Florida population of large brown shrimp on the deepwater grounds, far beyond the shallow coastal grounds, is the only such concentration ever located along the south Atlantic coast, (2) the summer population of inshore brown shrimp from the Carolinas to northeast Florida disappears from the shallow coastal shrimp grounds by September or October and does not return, and (3) since the closely related white shrimp migrates in the fall from North Carolina, South Carolina, and Georgia to northeast Florida (Lindner and Anderson, 1956), the brown shrimp might certainly do likewise.

Since 1965 there has been intermittent fishing on the offshore grounds for large brown shrimp.

Ovary development.--Table 6 gives data on ovarian development for the brown shrimp for outside grounds of the shallow coastal fishery for June through September.

The few females captured in May were all undeveloped; in June, all females were undeveloped, except for two in the developing stage; in July, 91.3 percent were undeveloped, 7.7 percent were developing, and 1.0 percent were yellow; in August, 92.9 percent were undeveloped, 5.4 percent were developing, and 1.7 percent were yellow; and in September, 65.3 percent were undeveloped, 24.3 percent developing, 4.0 percent yellow, and 6.4 percent were ripe without attached spermatophores. The smallest shrimp with developing ovaries was 113 mm., yellow 133 mm., and ripe 143 mm.

Joyce (1965), in his survey of the northeast Florida shallow outside fishing grounds during July 1962 to June 1963, found that all females in May were undeveloped except for one, which

was spent. He stated, "The number of females in some stage of development increased steadily through August 1962. After this time, total catches were much reduced but most of the larger females were in a developing stage through November. From December through April, only 15 females were taken offshore and all but 1 of these were undeveloped and less than 140 mm. in length. One female, in March, was in the 150-159 mm. range and was developing."

Figure 11 gives the size distributions and table 7 the ovary development of shrimp taken in a series of hauls made off northeast Florida by the Oregon between about lat. 28°00' and 29°30' N., and from 15 m. (8 fathoms) to 37 m. (20 fathoms) during July, August, and September in 1965 and 1966. In samples from 15 to 18 m. (8-10 fathoms), 24.3 percent were undeveloped, 72.0 percent were developing, and 3.7 percent were yellow. All of the few females taken between 18 and 37 m. (10-20 fathoms) were developing; none were shorter than 128 mm. These samples were from waters offshore to the shallow coastal fishing grounds.

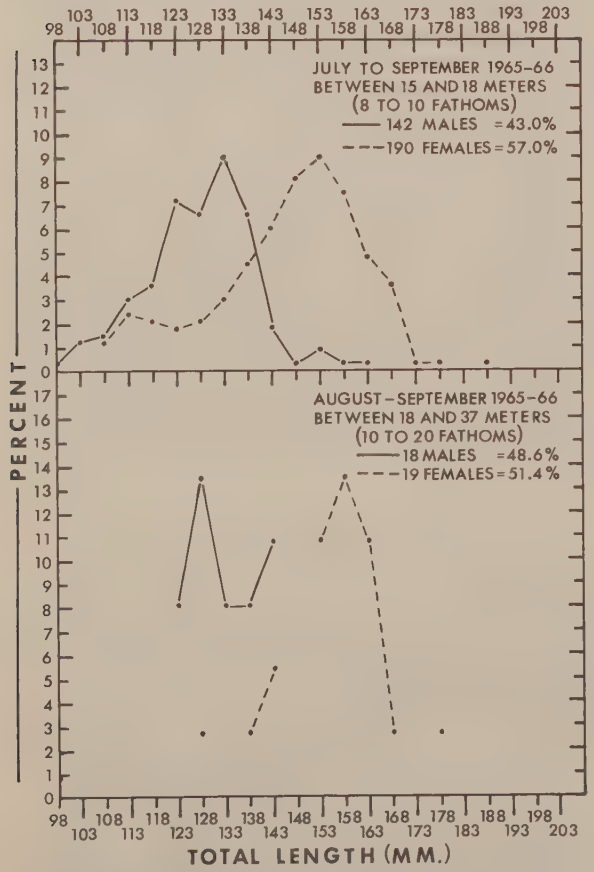

Figure 11.--Size distribution and sex ratios of brown shrimp off northeast Florida, between 15 and 37 m. (8-20 fathoms), July to September, 1965-66.

In a sample of 11 brown shrimp from Oregon station 5341, lat. 28°03' N. and long. 80°02.5' W., taken in 60 to 62 m. (33-34 fathoms) on March 13, 1965, 3 were males (148-158 mm. long) and 8 were females. All of the females -- one 168 mm. long, and 7 ranging from 183 to 203 mm. (about maximum size for the species) appeared to be spent.

Ovary development of shrimp on the shallow outside fishing grounds of northeast Florida is the same as that of shrimp taken in Georgia: females in the population of young shrimp during May and June have undeveloped ovaries; developing and yellow-stage ovaries increase in frequency in July to September and a few ripe females appear in September; and shrimp disappear from the shallow outside fishing grounds from fall to spring. In South Carolina I found females with developing ovaries during August and September but none with yellow or ripe ovaries.

From the records available, brown shrimp must spawn in Florida waters in fall and winter and almost entirely in waters offshore from the shallow coastal fishing grounds, as very few ripe females are captured on the shallow grounds. The concentration of very large brown shrimp in 55 to 66 m. (30-36 fathoms) off Cape Kennedy may well be the main spawning stock.

North Carolina

I have no brown shrimp records from this State, but Williams (1955) gave evidence of seasonal appearance of brown shrimp in the shallow coastal fishery similar to that in South Carolina, Georgia, and northeast Florida. In discussing recruitment of postlarvae onto the nursery grounds he said, "Recruitment to the annual populations is judged to extend from late February to early June with a peak in the first half of May."

Regarding brown shrimp in the North Carolina fishery, Williams (1955) said, "Penaeus aztecus enters the commercial fishery in June and recruitment continues until September .... The commercial shrimp season in North Carolina has been opened during the first half of May in recent years. During the first month of the season, nearly all of the catch is composed of P. duorarum, but in June P. aztecus young adults rather suddenly appear in catches made in the estuaries. Prior to this appearance, the young have been on the nursery grounds in the estuaries for two months or more and their extremely rapid growth accompanied by migration toward deeper water brings great numbers of the shrimp into fishable waters rather suddenly. The rapidly maturing young swell the number of individuals in the catches throughout the summer, especially in Pamlico Sound. Broad (1951a) wrote that this fishery reaches a peak in July and August. The adult population also shows

the summer recruitment by the continued low level of minimum sizes, but with the onset of autumn the numbers of adults decrease and recruitment of young ceases. Except for occasional individuals (inshore and offshore) no P. aztecus are known to overwinter in North Carolina waters."

PINK SHRIMP

I have records of pink shrimp only from a series of hauls made off northeast Florida by the Oregon between about lat. 28°00' and 29°30' N. and at 15 to 42 m. (8-23 fathoms) in July, August, and September 1965 and 1966; and in 42 to 44 m. (23-24 fathoms) in December 1967.

Size Distribution

The size distribution data are limited but do show that all sizes of pink shrimp occurred from about 15 to 42 m. (8-23 fathoms) during the summer period, July-September (fig. 12).

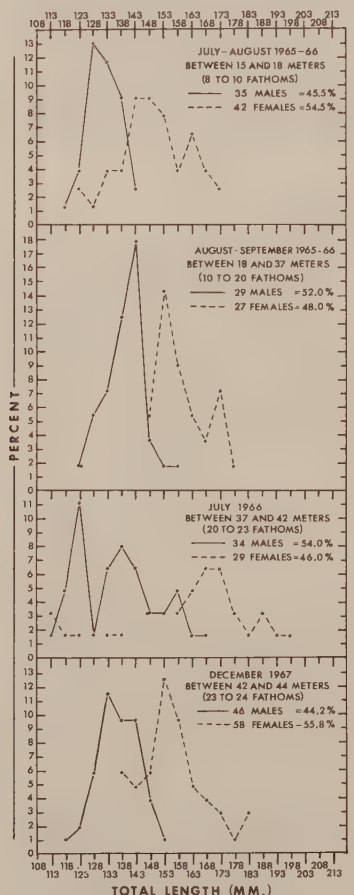

Figure 12.--Size distribution and sex ratios of pink shrimp off northeast Florida, between 15 and 42 m. (8-23 fathoms), July to September, 1965-66; and between 42 and 44 m. (23-24 fathoms), December 1967.

Pink shrimp taken in December in 42 to 44 m. (23-24 fathoms) were of similar size to those captured in July-September in 15 to 37 m. (8-20 fathoms).

Ovary Development

Females taken in 15 to 18 m. (8-10 fathoms) in July and August of 1965-66 were 2.4 percent undeveloped, 85.6 percent developing, and 12.0 percent yellow; between 18 and 37 m. (10-20 fathoms) in August and September 1965-66, 7.4 percent were undeveloped, 63.0 percent developing, and 29.6 percent yellow; and between 37 and 42 m. (20-23 fathoms) in July 1966, 13.8 percent were undeveloped, 82.7 percent developing, and 3.5 percent yellow (table 8). No ripe ovaries were found. The smallest female with developing ovaries was 123 mm. long, and with yellow-stage ovaries, 148 mm.

Ovaries of females in the December 1967 sample from 42 to 44 m. (23-24 fathoms) were 5.1 percent undeveloped, 83.0 percent developing, and 11.9 percent yellow (table 9). No ripe shrimp were found. The smallest female with developing ovaries was 138 mm., and with yellow-stage ovaries, 153 mm. The percentage with yellow ovaries was smaller in the December 1967 sample than in the July to September 1965-66 samples. As no ripe females were captured it is not possible to estimate time or place of spawning.

Joyce (1965), in discussing results of his survey in northeast Florida, said for pink shrimp with regard to ovary development, "There was a total of 52 females taken offshore in the following stages of development; 34 beginning development, 26 developing, and 2 developed. No ripe or spent P. duorarum were taken." Since my samples of pink shrimp, which were from deeper water than Joyce's, included a higher percentage of females with yellow-stage ovaries, there is an indication that as pink shrimp mature they move into deeper water beyond the shallow coastal fishing grounds.

SEA BOB

The sea bob -- a relatively small shrimp as compared to white, brown, or pink shrimps -- is of commercial importance in the United States only in the Louisiana shrimp fishery, where it makes up about 1 percent of the catch. Williams (1965) gave the known range of the species as Cape Hatteras, N.C., south through the Gulf of Mexico and Caribbean Sea to near Santos, Sao Paulo, Brazil.

Records on sea bobs were taken only intermittently, but those from the Georgia fishery are sufficient to make a significant contribution. I have length frequency and ovary development data for sea bobs from the Georgia

coast for January 1932 and 1933, February 1932, March 1932, April 1933, June 1932, July 1932, August 1931 and 1932, September 1931, 1932, and 1934, October 1931 and 1932, November 1931 and 1932, and December 1932; and for South Carolina for June 1933 and November 1934.

Records for South Carolina sea bobs are: off Cape Romain in November 1934, off Stono Inlet in June 1933, and near Gaskins Bank in January 1934. In northeast Florida I have records for: off St. Johns River, off St. Augustine, and off New Smyrna in January 1934; off Cape Kennedy in February 1934; and at St. Augustine Sea Buoy in March 1934. These records, together with the Georgia data, show distribution of the species during the early 1930's from Cape Romain, S.C., to Cape Kennedy, Fla.

In the early 1930's the sea bob was abundant on the Georgia shrimp grounds, in rivers, sounds, and the shallow coastal outside waters. It was especially abundant during late fall and winter when catches of several hundred pounds were not unusual during trawling for white shrimp. Following are examples of individual catches made during our own trawling for white shrimp off Georgia: December 14, 1931, off Sea Island, 113.4 kilograms (250 pounds); January 29, 1932, off Sea Island, 90.7 kilograms (200 pounds); February 18, 1932, off Jekyll Island, 4.5 kilograms (10 pounds); October 6, 1932, off Sea Island, 68.0 kilograms (150 pounds); November 10, 1932, off Jekyll Island, 11.3 kilograms (25 pounds); November 21, 1932, off Sapelo Island, 158.8 kilograms (350 pounds); December 6, 1932, off Sea Island, 45.4 kilograms (100 pounds); December 21, 1932, off Sapelo Island, 11.3 kilograms (25 pounds); January 5, 1933, off Sea Island, 68.0 kilograms (150 pounds); and September 13, 1934, Jekyll Creek, 22.7 kilograms (50 pounds).

There was no market in the 1930's for sea bobs (known in the Georgia fishery as "hardbacks"), and the catches were shoveled overside.

Apparently the abundance of sea bobs on the Georgia shrimping grounds has been drastically reduced since the early 1930's. Frisbie (1967), reporting on a survey of the Georgia shrimp fishery from July 1966 to June 1967 that included sampling from both inside and outside fishing grounds -- essentially the same as I fished in the early 1930's, said, "A single specimen of Xiphopeneus kroyeri was found." I have no explanation as to why this once abundant species has apparently almost vanished from the Georgia shrimping grounds.

Joyce (1965), reporting on a survey of the shallow coastal shrimp fishery of northeast Florida covering 17 months from July 1962 to November 1963, said, "A total of only 42 Xiphopeneus kroyeri were taken offshore and half of these were caught during the peak month of December 1962. Only one specimen was taken inshore and that was in October 1962. The first specimens were taken in October and catches increased until December. After this peak, catches declined rapidly. From February to the end of sampling, only two other specimens were taken." Joyce's sampling in the outside waters ended in June. Neither my records from the early 1930's nor Joyce's in 1962-63 indicated sea bobs to be abundant in the shallow coastal shrimp fishery of northeast Florida.

Georgia

The Georgia shrimp grounds are a narrow belt along the coast consisting of rivers, sounds, and the close inshore ocean waters. In discussing the sea bob, I treat the fishery as a unit.

Size distribution.--Figure 13 shows distribution and sex ratios of sea bobs for all months except May. In January, February, and April the mode for males was 93 mm.; in March it was 93 to 98 mm. For females the mode was 98 mm. in January, 93 mm. in February, 103 mm. in March, and 98 mm. in April. By June (I have no records for May) the mode for males was 108 mm. with a size spread of only 93 to 113 mm.; and for females a mode of 128 mm. with a size spread of only 113 to 133 mm. The June sample was obviously mature adults.

In July it is apparent that a new crop of sea bobs had appeared on the fishing grounds; the modal lengths were 83 mm. for males and 103 mm. for females. The largest males and females of the July samples were not as big as the smallest males and females of the June group.

The August samples show evidence of continued recruitment of young shrimp onto the fishing grounds, which results in a bimodal size distribution with modes at 73 and 83 mm. for males and 83 and 98 mm. for females. This recruitment -- as evidenced by the presence of shrimp about 53 to 63 mm. long -- continued to November and shifted modes of 78 mm. for males in September to 93 mm. in October; the length distribution was bimodal in November, with modes at 83 and 93 mm. For females there was a mode of 93 mm. in September, 103 mm. in October, and a bimodal distribution in November with modes at 88 and 103 mm.

Recruitment of young sea bobs to the fishing grounds evidently ceased or slowed drastically after November. The modes were 93 mm. for males and 98 mm. for females in December -- the same as in January.

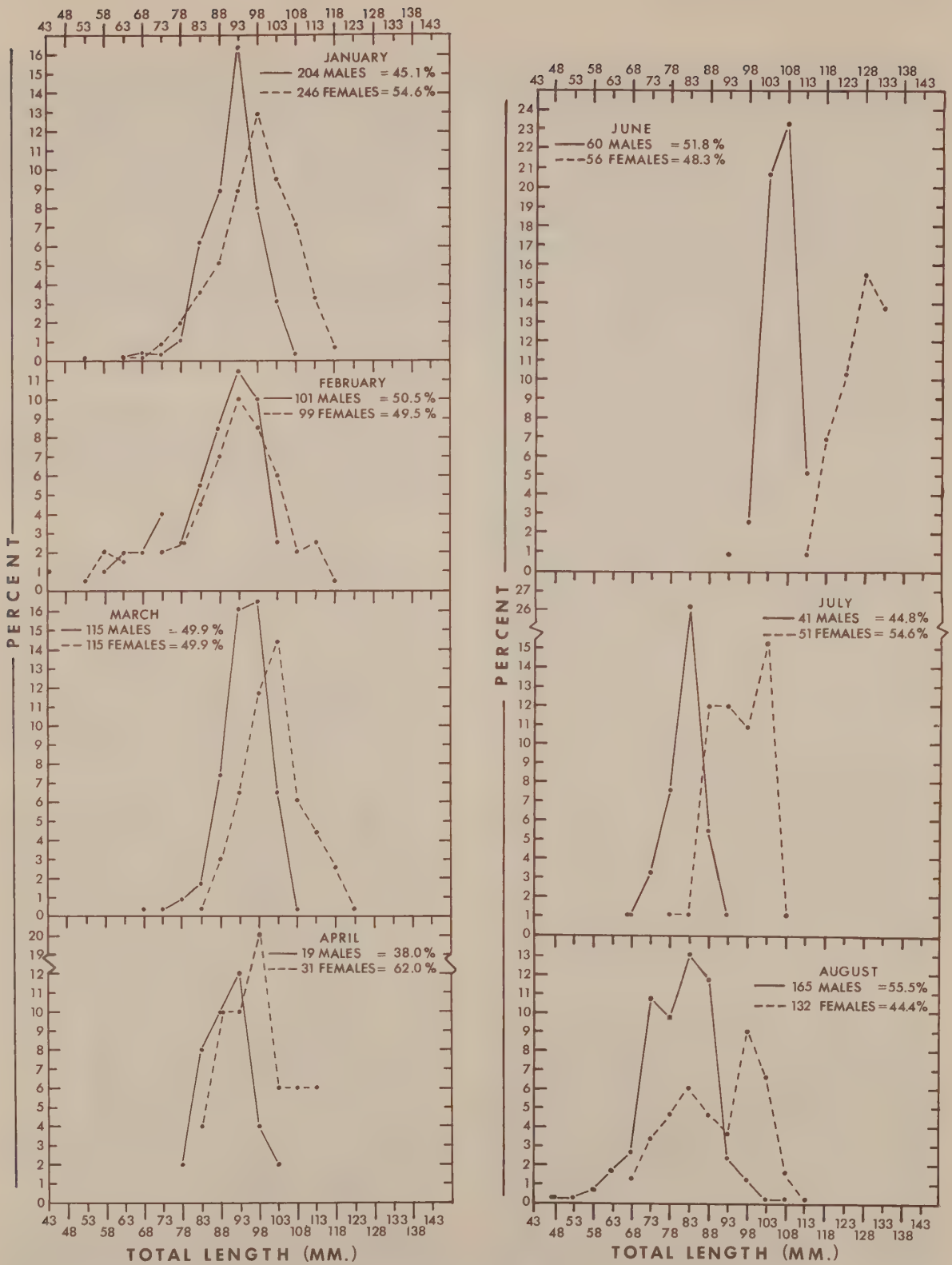

Figure 13.--Size distribution and sex ratios of sea bobs on Georgia fishing grounds by month, January to April and June to December, 1931-34.

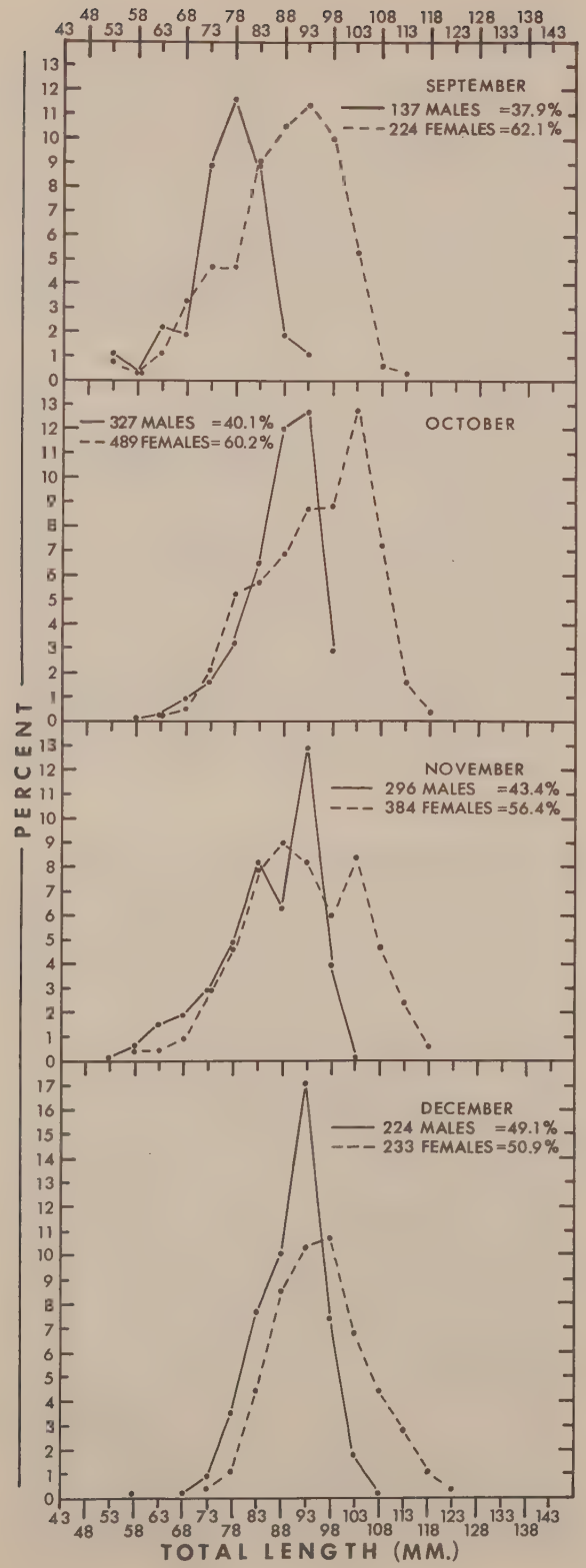

Figure 13.--Continued.

Heavy recruitment of young shrimp to the fishing grounds during summer and fall is consistent with sea bobs being most abundant on the Georgia fishing grounds during late fall and winter.

Ovary development.--Table 10 presents data on development of ovaries of sea bobs for all months but May. All females captured in January and February had undeveloped ovaries. In March 87.7 percent were undeveloped, 11.4 percent were developing, and 0.9 percent were yellow. In April 16.1 percent were undeveloped, 38.8 percent developing, 38.7 percent ripe without attached spermatophores, and 6.4 percent ripe with attached spermatophores. In June there were no undeveloped ovaries, 1.8 percent were developing, 21.5 percent yellow, 9.0 percent ripe without attached spermatophores, and 67.7 percent ripe with attached spermatophores. In July through October, the relatively high percentage of shrimp classified as having developing ovaries probably included spent shrimp, which we did not distinguish from those with developing ovaries. In July 19.7 percent were developing, 37.1 percent yellow, and 43.2 percent ripe with attached spermatophores. In August, with the influx of young shrimp onto the grounds, 7.6 percent were undeveloped, 21.9 percent developing, 18.3 percent yellow, 3.1 percent ripe without spermatophores, and 49.1 percent ripe with attached spermatophores. In September 33.2 percent were undeveloped, 24.4 percent developing, 6.5 percent yellow, 18.1 percent ripe without attached spermatophores, and 17.8 percent ripe with attached spermatophores. For October 62.3 percent were undeveloped, 26.5 percent developing, 1.8 percent yellow, 8.6 percent ripe without attached spermatophores, and only 0.8 percent ripe with attached spermatophores. For November 92.2 percent were undeveloped, 6.8 percent developing, 0.5 percent yellow, and 0.5 percent ripe without attached spermatophores. In December all females had undeveloped ovaries.

The smallest female with ripe ovaries and attached spermatophore was 63 mm. long.

If the occurrence of females with ripe ovaries and attached spermatophores is used as a criterion for spawning activity, spawning begins as early as April, peaks in June, July, and August, and tapers off in the fall. There is still considerable spawning in September, but only occasional spawning in October, and none from November through March. This seasonal progression follows very closely that for white shrimp (Lindner and Anderson, 1956).

South Carolina

Size distribution.--I have adequate size distribution data for the sea bob only for November in South Carolina's shallow coastal shrimp fishery. In this month the mode was 88 mm. for males and 88 and 98 mm. for females (fig. 14) -- similar to that found for the Georgia grounds in November.

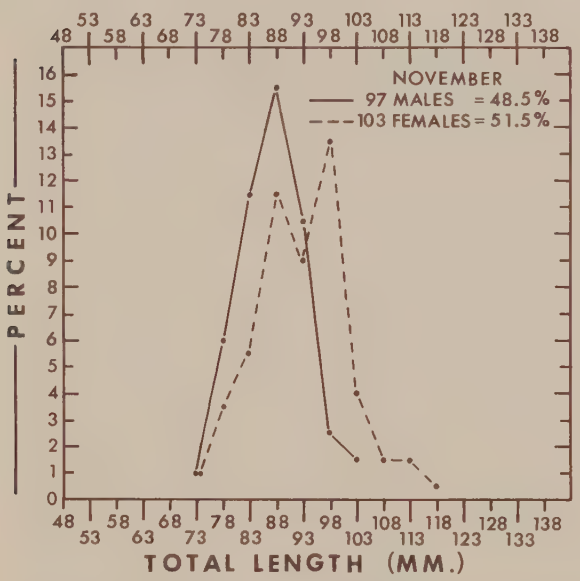

Figure 14.--Size distribution and sex ratio of sea bobs on South Carolina outside fishing grounds, November 1934.

Ovary development.--Of 15 females captured in South Carolina in June, 20 percent were developing, 26.6 percent yellow, 13.4 percent ripe without attached spermatophores, and 40 percent ripe with attached spermatophores (table 11). In November all females had undeveloped ovaries except for one with developing ovaries.

These limited data suggest that the spawning time in South Carolina is similar to that in Georgia.

TRACHYPENEUS CONSTRICTUS

Trachypeneus constrictus is a small penaeid shrimp taken very frequently on the shallow coastal shrimp fishing grounds of the south Atlantic coast. Williams (1965) gave the known range as, "Tangier Sound, Chesapeake Bay, to Texas; Bermuda; Puerto Rico and Sombrero Island; Surinam." He gave habitat as, "Primarily sand or mud and shell bottom in high-salinity waters; shallow water to 30 fathoms."

Georgia

I have limited size distribution data for the shallow coastal fishing grounds for November and December 1931; March, April, May, and June 1932; and January 1933. All samples except for June and December were from inside grounds. Ovary development data are available for all the listed months except December. Comparisons of sex ratios, sizes, ovary development, and spawning are made with limited data from South Carolina, and published data for northeast Florida.

The size distribution and sex ratios (fig. 15) have two obvious features -- an unbalanced sex ratio and a great disparity in sizes of males and females. Of the 384 specimens from Georgia only 31 or about 8 percent were males, and in the various months the ratio varied between 0 and 22 percent. Joyce (1965), reporting on a survey of the shallow coastal shrimping grounds of northeast Florida, said of this species, "Only 14.4 percent of the total offshore T. constrictus catch were males." In my sample of 37 specimens from the South Carolina shrimping grounds in May 1935, only 5 (13.5 percent) were males; and a sample in June 1935 of 18 specimens contained no males. It is apparent that the percentage of males is very low on the shallow coastal shrimping grounds from South Carolina to northeast Florida.

Size distribution.--Length distribution varied widely during the year. In November the females were 63 to 88 mm. long with a mode at 78 mm.; the one male was 58 mm. In December the females were 48 to 88 mm. long with a mode at 73 mm.; the three males were 43 to 58 mm. In January females were 58 to 83 mm. long (most were between 68 and 83 mm.); males were 48 to 63 mm. with a mode at 53 mm. In March females were from 58 to 88 mm. long, with 73 to 83 mm. the most abundant sizes; the one male was 63 mm. The size range of females in April was 48 to 93 mm., with 68 to 83 mm. the most abundant sizes; the 17 males were 48 to 63 mm. long, with a distinct mode at 53 mm. In May there was a regression in size -- females were 33 to 83 mm. long, with a mode at only 58 mm.; the one male was 38 mm. The small June sample, all females, showed a still further size regression with a range from 38 to 53 mm. and a mode at 43 mm.

The largest male was 63 mm., and the largest female 93 mm. Figure 15 shows the great disparity in sizes of males and females in any single sample. Joyce (1965) found a similar situation for the northeast Florida grounds and said, "Only three males were taken above the 50-59 mm. range as compared

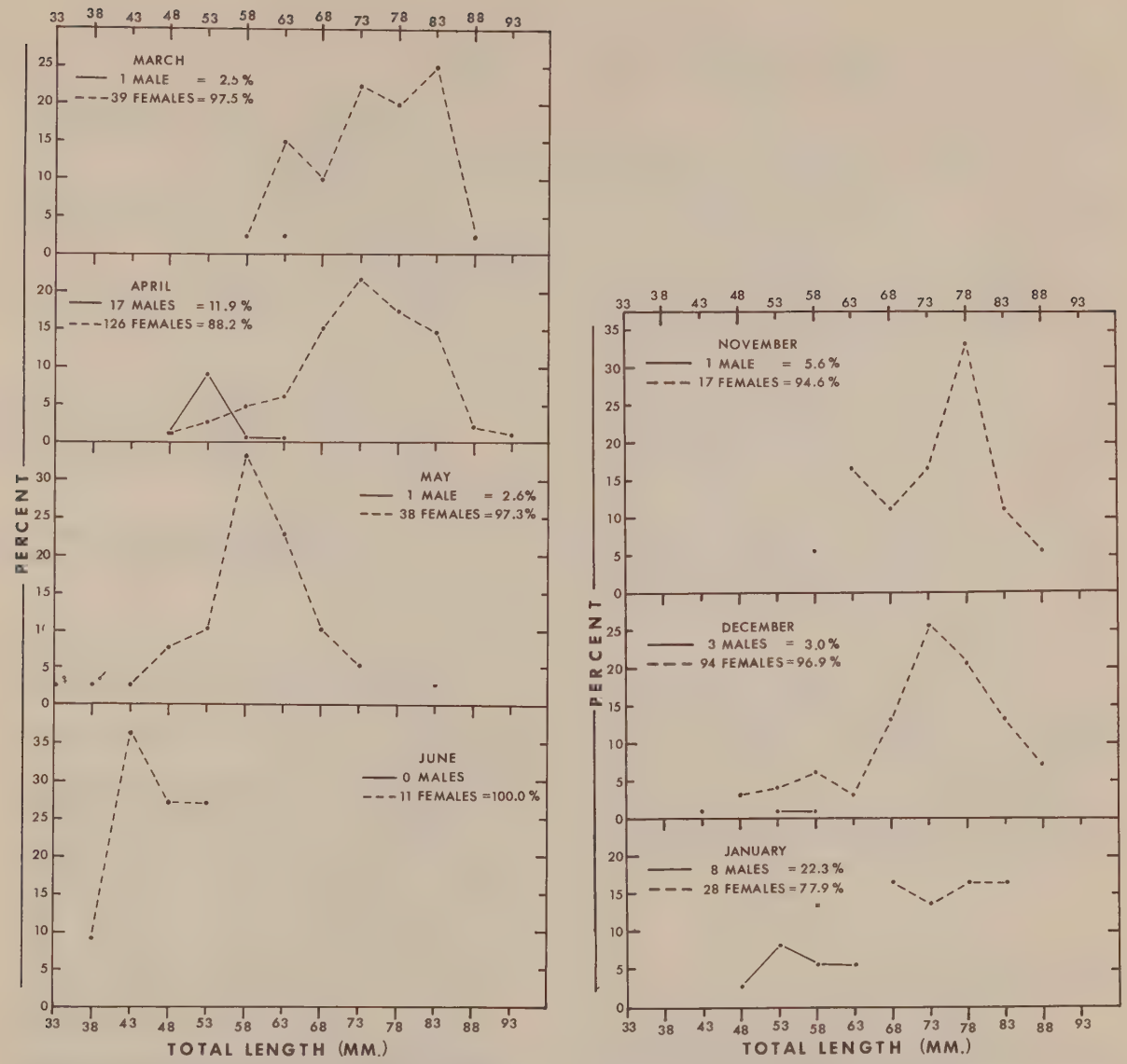

Figure 15.--Size distribution and sex ratios of Trachypeneus constrictus on Georgia fishing grounds by month, January 1933, March to June 1932, and November and December 1931.

to 344 females taken above this range." My small May 1935 sample from the South Carolina shrimp grounds had 32 females 58 to 93 mm. long, with a mode at 63 mm., and 5 males from 43 to 53 mm. (3 were 53 mm.); and a sample of 18 taken off South Carolina in June 1935 contained all females ranging from 73 to 83 mm., with a mode at 78 mm.

Ovary development.--Table 12 shows ovary development in samples of T. constrictus. All females taken in November had undeveloped ovaries. In January all females were undeveloped except for one with developing ovaries. Ovary development was not recorded for December, but I assume that nearly all were undeveloped. For March 23.2 percent were undeveloped, 30.6 percent developing, 38.5 percent yellow, and 7.7 percent ripe with attached spermatophores. In April 11.2 percent were undeveloped, 47.2 percent developing, 15.2 percent yellow, 15.2 percent ripe without attached spermatophores, and 11.2 percent ripe with attached spermatophores. For May 68.5 percent were undeveloped, 21.0 percent developing, 7.9 percent yellow, and 2.6 percent ripe with attached spermatophores.

The June sample contained only small shrimp (fig. 15); 72.7 percent were undeveloped, 9.1 percent developing, and 18.2 percent were yellow.

The smallest female with ripe ovaries was 63 mm. long. The maturity data for Georgia suggest that the species spawns in Georgia waters from at least March to June.

The May 1935 sample from the South Carolina shrimping grounds had 31.2 percent with undeveloped ovaries, 18.8 percent developing, 18.8 percent yellow, and 31.3 percent ripe with attached spermatophores; the June 1935 sample had 61.3 percent with developing ovaries, 16.7 percent yellow, and 22.2 percent ripe with attached spermatophores. These data indicate that the species spawns in South Carolina waters at least in May and June, and that the spawning season is similar to that in Georgia.

Joyce (1965) said for the northeast Florida shrimping grounds, "The peak percentage of impregnated females occurred in April and May, and the appearance of the first recruits in mid June. Therefore, it appears that spawning may begin as early as April and probably reaches a peak in May."

From the available records for South Carolina, Georgia, and northeast Florida, it is evident that there is a similar spawning period -- from spring to early summer -- on the shallow coastal shrimping grounds along the three States.

The species occurs in waters offshore to the coastal shrimping grounds but I have no maturity data from that area and hence no knowledge of offshore spawning.

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Table 1.--Average monthly surface water temperatures (° C.) for indicated sections of the shallow coastal shrimp fishing grounds, 1931-35

Month	South Carolina	Georgia			Florida outside		
	Outside	Creeks	Sounds	Outside	St. Augustine	New Smyrna	Cape Kennedy
	° C.	° C.	° C.	° C.	° C.	° C.	° C.
January	12.6	15.2	14.4	14.7	16.1	17.0	20.2
February	9.5	15.7	14.0	13.3	12.6	14.3	17.7
March	12.7	15.3	14.3	14.6	16.4	17.7	18.6
April	17.4	19.3	19.8	19.3	19.8	22.4	23.7
May	24.1	24.3	24.7	23.8	24.2	25.4	26.2
June	26.9	27.5	27.1	26.7	25.9	26.9	26.7
July	27.2	29.3	29.0	28.6	25.0	25.2	25.8
August	28.7	28.8	28.8	27.7	24.8	25.8	28.3
September	27.8	26.7	27.6	26.0	27.0	29.7	29.0
October	20.9	23.7	23.0	23.1	26.3	27.0	27.0
November	14.9	18.3	17.8	17.8	21.8	22.6	22.2
December	13.8	15.4	15.1	15.3	18.1	20.1	20.6

Table 2.--Ovary development of brown shrimp on Georgia inside fishing grounds, by size and month, June to September, 1931-34

Total length	June		July		August						September					
	Undeveloped		Undeveloped		Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
63	-	-	-	-	-	-	-	-	-	-	1	1.2	-	-	-	-
68	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
73	1	0.1	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
78	1	0.1	2	0.1	-	-	-	-	-	-	-	-	-	-	-	-
83	9	1.1	3	0.2	3	0.3	-	-	-	-	-	-	-	-	-	-
88	12	1.5	4	0.3	3	0.3	-	-	-	-	1	1.2	-	-	-	-
93	19	2.3	11	0.8	4	0.4	-	-	-	-	1	1.2	-	-	-	-
98	30	3.7	26	1.8	10	1.1	-	-	-	-	1	1.2	-	-	-	-
103	66	8.1	47	3.2	19	2.0	-	-	-	-	3	3.7	-	-	-	-
108	61	7.4	63	4.3	16	1.7	-	-	-	-	1	1.2	-	-	-	-
113	75	9.2	80	5.5	18	1.9	-	-	-	-	1	1.2	-	-	-	-
118	115	14.0	144	9.9	43	4.6	-	-	-	-	2	2.4	-	-	-	-
123	123	15.0	195	13.3	63	6.7	-	-	-	-	5	6.1	-	-	-	-
128	108	13.1	230	15.7	62	6.6	-	-	-	-	4	4.9	-	-	-	-
133	92	11.2	276	19.0	92	9.8	1	0.1	-	-	6	7.3	1	1.2	-	-
138	62	7.6	202	13.9	97	10.6	1	0.1	-	-	5	6.1	-	-	-	-
143	27	3.3	107	7.4	130	13.9	-	-	-	-	7	8.5	-	-	-	-
148	7	0.8	48	3.3	113	12.3	6	0.6	2	0.2	5	6.1	3	3.7	-	-
153	8	1.0	13	0.9	117	12.6	16	1.7	4	0.4	4	4.9	4	4.9	-	-
158	2	0.2	3	0.2	56	6.0	9	1.0	2	0.2	8	9.8	6	7.4	-	-
163	1	0.1	-	-	23	2.5	10	1.1	-	-	4	4.9	3	3.7	1	1.2
168	1	0.1	-	-	4	0.4	7	0.7	1	0.1	-	-	2	2.4	-	-
173	-	-	-	-	-	-	1	0.1	-	-	-	-	2	2.4	-	-
178	-	-	-	-	-	-	-	-	-	-	-	-	1	1.2	-	-
Total	820	100.0	1456	100.0	873	93.7	51	5.4	9	0.9	59	71.9	22	26.9	1	1.2

Table 3.--Ovary development of brown shrimp on Georgia outside fishing grounds, by size and month, June to September, 1931-35

Total length	June		July				August						September							
	Undeveloped		Undeveloped		Developing		Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow		Ripe -	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	1	2.5	-	-	-	-	2	0.2	-	-	-	-	-	-	-	-	-	-	-	-
98	1	2.5	2	0.3	-	-	7	0.7	-	-	-	-	1	0.8	-	-	-	-	-	-
103	1	2.5	12	1.7	-	-	8	0.9	-	-	-	-	1	0.8	-	-	-	-	-	-
108	3	7.5	12	1.7	-	-	14	1.5	-	-	-	-	-	-	-	-	-	-	-	-
113	3	7.5	44	6.1	-	-	13	1.4	-	-	-	-	-	-	-	-	-	-	-	-
118	9	22.5	41	5.7	-	-	46	4.9	-	-	-	-	-	-	-	-	-	-	-	-
123	10	25.0	80	11.0	-	-	53	5.7	-	-	-	-	4	3.2	-	-	-	-	-	-
128	6	15.0	124	17.1	-	-	84	9.0	-	-	-	-	3	2.4	-	-	-	-	-	-
133	1	2.5	136	18.8	-	-	104	11.3	-	-	-	-	2	1.6	-	-	-	-	-	-
138	3	7.5	127	17.5	-	-	124	13.4	-	-	-	-	3	2.4	1	0.8	-	-	-	-
143	1	2.5	88	12.1	-	-	130	13.9	4	0.4	-	-	4	3.2	3	2.4	-	-	-	-
148	1	2.5	45	6.2	1	0.1	106	11.3	2	0.2	1	0.1	8	6.2	5	4.0	3	2.4	-	-
153	-	-	9	1.2	-	-	85	9.1	14	1.5	-	-	4	3.1	5	4.0	3	2.4	-	-
158	-	-	3	0.4	-	-	43	4.6	24	2.6	-	-	3	2.4	13	10.2	15	11.9	2	1.6
163	-	-	-	-	-	-	18	1.9	21	2.2	1	0.1	1	0.8	7	5.5	14	11.1	2	1.6
168	-	-	-	-	-	-	5	0.5	13	1.4	-	-	2	1.6	6	4.8	3	2.4	-	-
173	-	-	-	-	-	-	2	0.2	6	0.6	-	-	1	0.8	3	2.4	1	0.8	-	-
178	-	-	-	-	-	-	-	-	2	0.2	1	0.1	1	0.8	-	-	1	0.8	-	-
183	-	-	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	1	0.8	-	-
Total	40	100.0	724	99.9	1	0.1	844	90.5	87	9.2	3	0.3	38	30.1	43	34.1	41	32.6	4	3.2

Table 4.--Ovary development of brown shrimp on South Carolina outside fishing grounds, by size and month, June to September, 1933-34

Total length	June		July				August				September			
	Undeveloped		Undeveloped		Developing		Undeveloped		Developing		Undeveloped		Developing	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	1	0.4	-	-	-	-	-	-	-	-	-	-	-	-
73	3	1.2	-	-	-	-	-	-	-	-	-	-	-	-
78	6	2.4	-	-	-	-	-	-	-	-	-	-	-	-
83	24	9.6	-	-	-	-	-	-	-	-	-	-	-	-
88	25	10.0	2	0.4	-	-	-	-	-	-	-	-	-	-
93	29	11.5	8	1.5	-	-	-	-	-	-	-	-	-	-
98	37	14.7	12	2.2	-	-	1	0.3	-	-	2	1.4	-	-
103	30	11.9	23	4.3	-	-	1	0.3	-	-	2	1.4	-	-
108	37	14.7	33	6.2	-	-	2	0.6	-	-	2	1.4	-	-
113	33	13.2	41	7.7	-	-	2	0.6	-	-	4	2.9	-	-
118	17	6.8	56	10.5	-	-	13	4.1	-	-	5	3.6	-	-
123	9	3.6	69	12.9	-	-	26	8.2	-	-	16	11.4	-	-
128	-	-	86	16.1	-	-	37	11.7	-	-	31	22.3	-	-
133	-	-	63	11.8	-	-	44	13.9	-	-	23	16.4	-	-
138	-	-	56	10.5	-	-	57	18.2	-	-	16	11.4	-	-
143	-	-	43	8.0	-	-	45	14.4	-	-	18	12.9	-	-
148	-	-	29	5.4	-	-	37	11.7	-	-	9	6.4	2	1.4
153	-	-	11	2.1	-	-	27	8.5	2	0.6	4	2.9	-	-
158	-	-	-	-	-	-	16	5.1	1	0.3	3	2.1	-	-
163	-	-	1	0.2	1	0.2	2	0.6	1	0.3	2	1.4	-	-
168	-	-	-	-	-	-	1	0.3	1	0.3	1	0.7	-	-
Total	251	100.0	533	99.8	1	0.2	311	98.5	5	1.5	138	98.6	2	1.4

Table 5.--Data from series of stations made by R/V Oregon off northeast Florida, showing location of trawl hauls, depth, date, species of shrimp captured and their number and size range, March 12-14, 1965

OREGON station number	Location N. lat.	Location W. long.	Depth M.	Depth Fath.	Date 1965	Species	Shrimp collected Number	Total length Mm.	Remarks
5331	28° 10.5'	80° 18'	22-24	12-13	3/12	Penaeus duorarum	12	125-175	Mostly 150 mm. and larger
						Trachypeneus constrictus	28	-	
5332	28° 14'	80° 22'	20-22	11-12	3/12	Penaeus duorarum	26	115-170	Mostly 150 mm. and larger
5333	28° 12.5'	80° 22.5'	20-22	11-12	3/13	Penaeus aztecus	1	175	Mostly 150 mm. and larger
						Penaeus duorarum	33	110-170	
5334	28° 10'	80° 28'	18-22	10-12	3/13	Penaeus aztecus	1	175	Mostly 150 mm. and larger
						Penaeus duorarum	39	103-168	
						Penaeus setiferus	3	160-190	
						Trachypeneus constrictus	1	-	
5338	27° 59.5'	80° 02.5'	55	30	3/13	Penaeus aztecus	15	155-190	Mostly 160 mm. and larger
						Penaeus duorarum	1	150	
5339	27° 59'	80° 02.5'	60	33	3/13	Penaeus aztecus	18	150-190	Mostly 175 mm. and larger
5340	28° 03.5'	80° 02'	64-66	35-36	3/13	Penaeus aztecus	4	140-170	
5341	28° 03'	80° 02.5'	60-62	33-34	3/13	Penaeus aztecus	80	150-205	Mostly 175 mm. and larger
5342	27° 59'	80° 03'	60-66	33-36	3/13	Penaeus aztecus	97	144-194	Mostly 160 mm. and larger
						Penaeus duorarum	1	165	
5343	28° 08'	80° 02.5'	59-62	32-34	3/13	Penaeus aztecus	98	160-207	Mostly 175 mm. and larger
						Penaeus duorarum	1	170	
5344	28° 12'	80° 05'	60	33	3/14	Penaeus aztecus	82	145-200	Mostly 175 mm. and larger
5345	28° 17'	80° 05'	60	33	3/14	Penaeus aztecus	23	152-190	Mostly 175 mm. and larger
						Penaeus duorarum	1	150	
5346	28° 22'	80° 05'	60	33	3/14	Penaeus aztecus	38	149-197	Mostly 175 mm. and larger
						Penaeus duorarum	1	153	
5349	27° 51'	80° 01.5'	55	30	3/14	Penaeus aztecus	14	145-192	Mostly 160 mm. and larger
5350	27° 45.5'	80° 00.5'	62-64	34-35	3/14	Penaeus aztecus	50	140-190	Mostly 160 mm. and larger

Table 6.--Ovary development of brown shrimp on northeast Florida outside fishing grounds, by size and month, June to September, 1933-35

Total length	June				July						August						September							
	Undeveloped		Developing		Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow		Ripe -	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-
73	1	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	-	-	-	-	-	-	-	-	-	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-
83	1	0.4	-	-	1	0.2	-	-	-	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-
88	1	0.4	-	-	-	-	-	-	-	-	7	1.9	-	-	-	-	2	1.6	-	-	-	-	-	-
93	2	0.8	-	-	2	0.4	-	-	-	-	7	1.9	-	-	-	-	2	1.6	-	-	-	-	-	-
98	4	1.6	-	-	10	1.9	-	-	-	-	10	2.7	-	-	-	-	2	1.6	-	-	-	-	-	-
103	6	2.4	-	-	6	1.2	-	-	-	-	9	2.4	-	-	-	-	2	1.6	-	-	-	-	-	-
108	10	4.1	-	-	10	1.9	-	-	-	-	10	2.7	-	-	-	-	1	0.8	-	-	-	-	-	-
113	11	4.5	-	-	21	4.1	1	0.2	-	-	16	4.3	-	-	-	-	2	1.6	-	-	-	-	-	-
118	15	6.1	-	-	41	8.0	-	-	-	-	33	8.8	-	-	-	-	3	2.4	-	-	-	-	-	-
123	26	10.7	-	-	51	9.9	-	-	-	-	50	13.2	-	-	-	-	7	5.5	1	0.8	-	-	-	-
128	32	13.1	1	0.4	71	13.8	1	0.2	-	-	46	12.1	-	-	-	-	7	5.5	-	-	-	-	-	-
133	39	15.9	1	0.4	47	9.1	-	-	-	-	49	13.1	-	-	-	-	17	13.2	2	1.6	1	0.8	-	-
138	32	13.1	-	-	44	8.5	-	-	-	-	41	10.8	3	0.8	-	-	15	11.8	4	3.1	3	2.4	-	-
143	23	9.4	-	-	46	8.9	-	-	1	0.2	22	5.9	1	0.3	2	0.5	14	11.0	4	3.1	-	-	1	0.8
148	20	8.2	-	-	30	5.8	1	0.2	1	0.2	25	6.7	7	1.9	1	0.3	5	3.9	5	3.9	-	-	2	1.6
153	13	5.3	-	-	32	6.2	4	0.8	1	0.2	4	1.1	3	0.8	1	0.3	2	1.6	6	4.7	-	-	3	2.4
158	5	2.0	-	-	28	5.4	6	1.2	-	-	3	0.8	2	0.5	-	-	1	0.8	6	4.7	-	-	2	1.6
163	1	0.4	-	-	18	3.5	10	1.9	1	0.2	6	1.6	-	-	1	0.3	1	0.8	3	2.4	1	0.8	-	-
168	-	-	-	-	9	1.7	5	1.0	1	0.2	1	0.3	2	0.5	-	-	-	-	-	-	-	-	-	-
173	1	0.4	-	-	4	0.8	7	1.4	-	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-
178	-	-	-	-	-	-	4	0.8	-	-	1	0.3	1	0.3	1	0.3	-	-	-	-	-	-	-	-
183	-	-	-	-	-	-	-	-	-	-	1	0.3	1	0.3	-	-	-	-	-	-	-	-	-	-
Total	243	99.2	2	0.8	471	91.3	39	7.7	5	1.0	349	92.9	20	5.4	6	1.7	83	65.3	31	24.3	5	4.0	8	6.4

Table 7.--Ovary development of brown shrimp off northeast Florida, by size and depth, July to September, 1965-66

Total length	Under 18 meters (10 fathoms)						Between 18 and 37 meters (10 to 20 fathoms)	
	Undeveloped		Developing		Yellow		Developing	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent
108	4	2.1	-	-	-	-	-	--
113	8	4.2	-	-	-	-	-	-
118	7	3.7	-	-	-	-	-	-
123	6	3.2	-	-	-	-	-	-
128	7	3.7	-	-	-	-	1	5.3
133	10	5.3	-	-	-	-	-	-
138	3	1.6	12	6.3	-	-	1	5.3
143	-	-	20	10.5	-	-	2	10.5
148	-	-	27	14.2	-	-	-	-
153	-	-	28	14.7	2	1.1	4	21.0
158	-	-	24	12.7	1	0.5	5	26.3
163	1	0.5	14	7.4	1	0.5	4	21.0
168	-	-	9	4.7	3	1.6	1	5.3
173	-	-	1	0.5	-	-	-	-
178	-	-	1	0.5	-	-	1	5.3
183	-	-	-	-	-	-	-	-
188	-	-	1	0.5	-	-	-	-
Total	46	24.3	137	72.0	7	3.7	19	100.0

Table 8.--Ovary development of pink shrimp off northeast Florida, by size and depth, July to September, 1965-66

Total length	Under 18 meters (10 fathoms)						Between 18 and 37 meters (10 to 20 fathoms)						Between 37 and 42 meters (20 to 23 fathoms)					
	Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow		Undeveloped		Developing		Yellow	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
113	-	-	-	-	-	-	-	-	-	-	-	-	2	6.8	-	-	-	-
118	-	-	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-	-	-
123	-	-	2	4.8	-	-	1	3.7	-	-	-	-	-	-	1	3.5	-	-
128	1	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	-	-	3	7.1	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-
138	-	-	3	7.1	-	-	-	-	-	-	-	-	1	3.5	-	-	-	-
143	-	-	7	16.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
148	-	-	6	14.3	1	2.4	-	-	3	11.1	-	-	-	-	2	6.8	-	-
153	-	-	6	14.3	-	-	1	3.7	4	14.9	3	11.1	-	-	-	-	-	-
158	-	-	2	4.8	1	2.4	-	-	3	11.1	2	7.4	-	-	2	6.8	-	-
163	-	-	4	9.5	1	2.4	-	-	3	11.1	-	-	-	-	3	10.4	-	-
168	-	-	2	4.8	1	2.4	-	-	-	-	2	7.4	-	-	3	10.4	1	3.5
173	-	-	1	2.4	1	2.4	-	-	3	11.1	1	3.7	-	-	4	13.7	-	-
178	-	-	-	-	-	-	-	-	1	3.7	-	-	-	-	2	6.8	-	-
183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-
188	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	6.8	-	-
193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-
198	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.5	-	-
Total	1	2.4	36	85.6	5	12.0	2	7.4	17	63.6	8	29.6	4	13.8	24	82.7	1	3.5

Table 9.--Ovary development of pink shrimp off northeast Florida, by size and depth, December 1967

Total length	Between 42 and 44 meters (23 to 24 fathoms)					
	Undeveloped		Developing		Yellow	
Millimeters	Number	Percent	Number	Percent	Number	Percent
118	2	3.4	-	-	-	-
123	-	-	-	-	-	-
128	-	-	-	-	-	-
133	-	-	-	-	-	-
138	1	1.7	5	8.6	-	-
143	-	-	5	8.6	-	-
148	-	-	6	10.5	-	-
153	-	-	12	20.8	1	1.7
158	-	-	9	15.7	1	1.7
163	-	-	4	6.9	1	1.7
168	-	-	2	3.4	2	3.4
173	-	-	2	3.4	1	1.7
178	-	-	1	1.7	-	-
183	-	-	2	3.4	1	1.7
Total	3	5.1	48	83.0	7	11.9

Table 10.--Ovary development of seabobs on Georgia fishing grounds, by size and month, January to April and June to December, 1931-34

Total length	January		February		March						April							
	Undeveloped		Undeveloped		Undeveloped		Developing		Yellow		Undeveloped		Developing		Ripe -		Ripe +	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	1	0.4	1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	4	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	1	0.4	3	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	1	0.4	-	-	1	0.9	-	-	-	-	-	-	-	-	-	-	-	-
73	4	1.6	4	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	9	3.7	5	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	16	6.5	9	9.1	1	0.9	-	-	-	-	-	-	2	6.5	-	-	-	-
88	23	9.4	14	14.1	7	6.1	-	-	-	-	1	3.2	2	6.5	1	3.2	1	3.2
93	40	16.2	20	20.3	14	12.2	1	0.9	-	-	3	9.7	1	3.2	1	3.2	-	-
98	58	23.6	17	17.2	27	23.4	-	-	-	-	1	3.2	3	9.7	5	16.1	1	3.2
103	43	17.5	12	12.1	32	27.6	1	0.9	-	-	-	-	1	3.2	2	6.5	-	-
108	32	13.0	4	4.0	11	9.6	3	2.6	-	-	-	-	2	6.5	1	3.2	-	-
113	15	6.1	5	5.1	5	4.4	4	3.5	1	0.9	-	-	1	3.2	2	6.5	-	-
118	3	1.2	1	1.0	3	2.6	3	2.6	-	-	-	-	-	-	-	-	-	-
123	-	-	-	-	-	-	1	0.9	-	-	-	-	-	-	-	-	-	-
128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	246	100.0	99	100.0	101	87.7	13	11.4	1	0.9	5	16.1	12	38.8	12	38.7	2	6.4

Table 10.--Continued

Total length	June								July					
	Developing		Yellow		Ripe -		Ripe +		Developing		Yellow		Ripe +	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-	1	2.0
78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	-	-	-	-	-	-	-	-	-	-	1	2.0	-	-
88	-	-	-	-	-	-	-	-	1	2.0	-	-	-	-
93	-	-	1	1.8	-	-	-	-	3	5.9	4	7.8	4	7.8
98	-	-	-	-	-	-	-	-	2	3.9	7	13.6	2	3.9
103	-	-	-	-	-	-	-	-	2	3.9	2	3.9	6	11.8
108	-	-	-	-	-	-	-	-	1	2.0	5	9.8	8	15.7
113	-	-	-	-	-	-	-	-	-	-	-	-	1	2.0
118	-	-	2	3.6	1	1.8	1	1.8	-	-	-	-	-	-
123	-	-	1	1.8	1	1.8	5	9.0	-	-	-	-	-	-
128	1	1.8	7	12.5	1	1.8	10	17.7	-	-	-	-	-	-
133	-	-	1	1.8	2	3.6	9	16.1	1	2.0	-	-	-	-
Total	1	1.8	12	21.5	5	9.0	13	23.1	-	-	-	-	-	-
							38	67.7	10	19.7	19	37.1	22	43.2

Table 10.--Continued

Total length	August										September									
	Undeveloped		Developing		Yellow		Ripe -		Ripe +		Undeveloped		Developing		Yellow		Ripe -		Ripe +	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
48	1	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	3	1.3	-	-	-	-	-	-	-	-
58	2	1.5	-	-	-	-	-	-	-	-	1	0.4	-	-	-	-	-	-	-	-
63	2	1.5	2	1.5	-	-	-	-	1	0.8	4	1.8	-	-	-	-	-	-	-	-
68	2	1.5	2	1.5	-	-	-	-	-	-	10	4.5	1	0.4	-	-	1	0.4	-	-
73	1	0.8	6	4.5	1	0.8	-	-	2	1.5	11	4.9	5	2.2	-	-	1	0.4	-	-
78	-	-	3	2.3	4	3.0	2	1.5	5	3.8	8	3.6	3	1.3	-	-	6	2.7	-	-
83	-	-	6	4.5	5	3.8	-	-	7	5.3	18	8.2	5	2.2	2	0.9	8	3.6	-	-
88	-	-	2	1.5	5	3.8	-	-	7	5.3	8	3.6	9	4.0	2	0.9	14	6.2	5	2.2
93	-	-	2	1.5	3	2.3	-	-	6	4.5	9	4.0	13	5.8	2	0.9	5	2.2	12	5.4
98	2	1.5	2	1.5	3	2.3	1	0.8	19	14.2	2	0.9	12	5.4	4	1.8	3	1.3	15	6.7
103	-	-	3	2.3	1	0.8	1	0.8	15	11.4	-	-	6	2.7	4	1.8	3	1.3	6	2.7
108	-	-	-	-	2	1.5	-	-	3	2.3	-	-	1	0.4	-	-	-	-	1	0.4
113	-	-	1	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4
118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	10	7.6	29	21.9	24	18.3	4	3.1	65	49.1	74	33.2	55	24.4	14	6.5	41	18.1	40	17.8

Table 10.--Continued

Total length	October										November								December	
	Undeveloped		Developing		Yellow		Ripe -		Ripe +		Undeveloped		Developing		Yellow		Ripe -		Undeveloped	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	3	0.8	-	-	-	-	-	-	-	-
63	2	0.4	-	-	-	-	-	-	-	-	3	0.8	-	-	-	-	-	-	-	-
68	4	0.8	-	-	-	-	-	-	-	-	6	1.6	-	-	-	-	-	-	-	-
73	17	3.5	-	-	-	-	-	-	-	-	20	5.2	-	-	-	-	-	-	2	2.0
78	41	8.4	1	0.2	-	-	-	-	-	-	31	8.1	-	-	-	-	-	-	3	3.0
83	45	9.2	1	0.2	-	-	-	-	-	-	54	14.0	-	-	-	-	-	-	11	11.0
88	52	10.7	4	0.8	-	-	-	-	-	-	61	15.9	-	-	-	-	-	-	14	14.0
93	56	11.4	14	2.9	-	-	1	0.2	-	-	53	13.8	3	0.8	-	-	-	-	17	17.0
98	39	8.0	29	5.9	1	0.2	3	0.6	-	-	41	10.7	-	-	-	-	-	-	13	13.0
103	33	6.8	48	9.8	3	0.6	17	3.5	3	0.6	51	13.3	6	1.6	-	-	-	-	15	15.0
108	13	2.7	24	4.9	4	0.8	18	3.7	-	-	24	6.2	6	1.6	-	-	2	0.5	13	13.0
113	2	0.4	7	1.4	1	0.2	2	0.4	1	0.2	7	1.8	9	2.3	-	-	-	-	6	6.0
118	-	-	2	0.4	-	-	1	0.2	-	-	-	-	2	0.5	2	0.5	-	-	4	4.0
123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2.0
128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	304	62.3	130	26.5	9	1.8	42	8.6	4	0.8	354	92.2	26	6.8	2	0.5	2	0.5	100	100.0

Table 11.--Ovary development of seabobs on South Carolina outside fishing grounds, by size, June 1933 and November 1934

Total length	June								November			
	Developing		Yellow		Ripe -		Ripe +		Undeveloped		Developing	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
68	-	-	-	-	-	-	-	-	2	1.9	-	-
73	-	-	-	-	-	-	-	-	7	6.8	-	-
78	-	-	-	-	-	-	-	-	11	10.7	-	-
83	-	-	-	-	-	-	-	-	23	22.3	-	-
88	-	-	-	-	-	-	-	-	18	17.5	-	-
93	-	-	-	-	-	-	-	-	27	26.2	-	-
98	-	-	-	-	-	-	-	-	8	7.8	-	-
103	-	-	-	-	-	-	-	-	3	2.9	-	-
108	-	-	-	-	-	-	-	-	2	1.9	1	1.0
113	-	-	-	-	-	-	-	-	1	1.0	-	-
118	-	-	1	6.7	-	-	1	6.7	-	-	-	-
123	1	6.7	2	13.2	1	6.7	3	20.0	-	-	-	-
128	2	13.3	1	6.7	-	-	2	13.3	-	-	-	-
133	-	-	-	-	1	6.7	-	-	-	-	-	-
Total	3	20.0	4	26.6	2	13.4	6	40.0	102	99.0	1	1.0

Table 12.--Ovary development of Trachypeneus constrictus on Georgia fishing grounds, by size and month, January 1933, March to June 1932, and November 1931

Total length	January				March								April									
	Undeveloped		Developing		Undeveloped		Developing		Yellow		Ripe +		Undeveloped		Developing		Yellow		Ripe -		Ripe +	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-	-	-	2	1.6	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-	3	2.4	1	0.8	-	-	-	-	-	-
58	5	17.9	-	-	1	2.6	-	-	-	-	-	-	3	2.4	1	0.8	3	2.4	-	-	-	-
63	-	-	-	-	6	15.4	-	-	-	-	-	-	2	1.6	3	2.4	2	1.6	2	1.6	-	-
68	6	21.4	-	-	1	2.6	2	5.1	1	2.6	-	-	-	-	12	9.5	2	1.6	5	4.0	3	2.4
73	5	17.9	-	-	-	-	7	17.8	2	5.1	-	-	4	3.2	14	11.1	4	3.2	4	3.2	5	4.0
78	6	21.4	-	-	1	2.6	1	2.6	5	12.8	1	2.6	-	-	16	12.5	5	4.0	1	0.8	3	2.4
83	5	17.9	1	3.5	-	-	2	5.1	6	15.4	2	5.1	-	-	11	8.5	2	1.6	6	4.8	2	1.6
88	-	-	-	-	-	-	-	-	1	2.6	-	-	-	-	2	1.6	1	0.8	-	-	-	-
93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.8	1	0.8
Total	27	96.5	1	3.5	9	23.2	12	30.6	15	38.5	3	7.7	14	11.2	60	47.2	19	15.2	19	15.2	14	11.2

Table 12.--Continued

Total length	May								June						November	
	Undeveloped		Developing		Yellow		Ripe +		Undeveloped		Developing		Yellow		Undeveloped	
Millimeters	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
33	1	2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	1	9.1	-	-	-	-	-	-
43	1	2.6	-	-	-	-	-	-	4	36.3	-	-	-	-	-	-
48	3	7.9	-	-	-	-	-	-	2	18.1	1	9.1	-	-	-	-
53	4	10.5	-	-	-	-	-	-	1	9.1	-	-	2	18.2	-	-
58	8	21.2	3	7.9	2	5.3	-	-	-	-	-	-	-	-	-	-
63	6	15.8	3	7.9	-	-	-	-	-	-	-	-	-	-	3	17.6
68	3	7.9	1	2.6	-	-	-	-	-	-	-	-	-	-	2	11.8
73	-	-	1	2.6	1	2.6	-	-	-	-	-	-	-	-	3	17.6
78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	35.3
83	-	-	-	-	-	-	1	2.6	-	-	-	-	-	-	2	11.8
88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5.9
93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	26	68.5	8	21.0	3	7.9	1	2.6	8	72.7	1	9.1	2	18.2	17	100.0

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